

Intermediate Forms and Range Extension of *Pedicularia californica* and *Pedicularia ovuliformis*

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(3 Text figures)

TWO FORMS OF *Pedicularia* are known from the California coast: *P. californica* (Newcomb, 1864) and *P. ovuliformis* (Berry, 1946). In comparison, the former is slightly larger, irregular, with simple outer lip, and lighter in color. The latter is uniform in size and shape, with a heavy

dentate outer lip, crenulate outer margin, and a rather intense rose-pink color. Heretofore, no specimens intermediate between these two forms or their existence north of the Farallon Islands have been known.

The October 1978 scuba expedition to Cordell Bank,

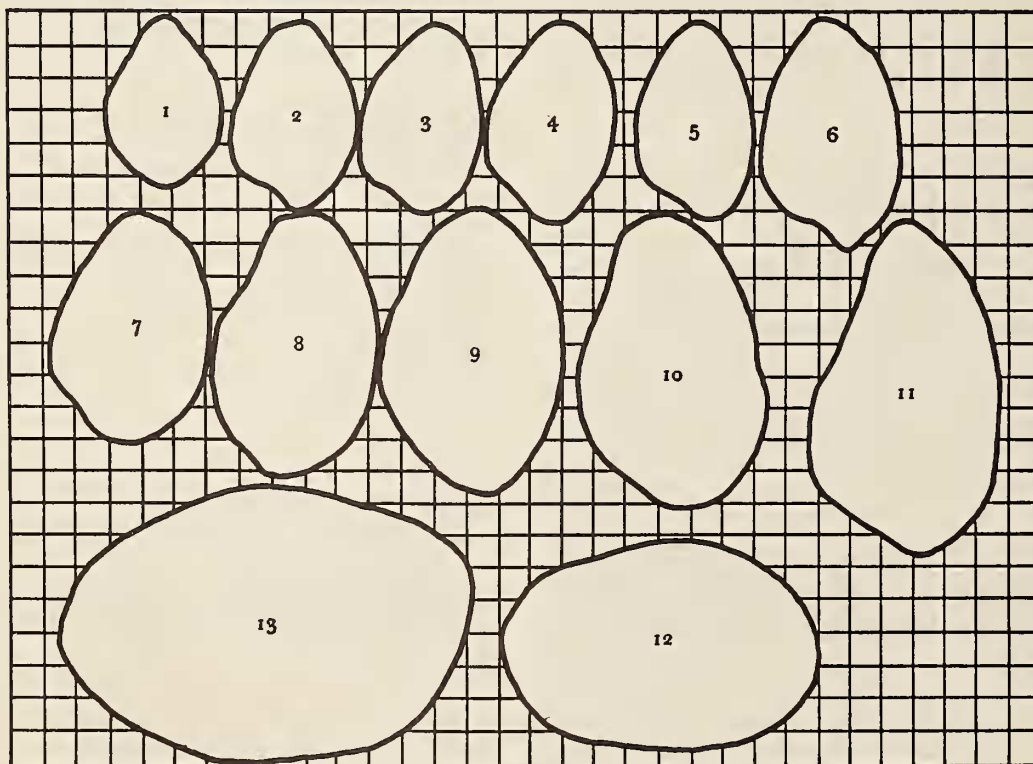


Figure 1

Outlines of the 1978 Cordell Bank *Pedicularia*, viewed dorsally. The grid spacing is 1 mm, and the numbering corresponds to the entries in Table 1

30 km W of Point Reyes, carried out by the author and colleagues (SCHMIEDER, 1979) yielded 13 specimens of *Pedicularia*, most collected live among abundant hydrocoral (*Stylantheca porphyra*), thus extending the range to Latitude 38° N. The specimens were collected in clear water (visibility ~18 m, temperature ~14° C) at depths of 39.6 to 46.8 m, from a tiny pinnacle at Latitude 37°-59'30", Longitude 123°24'30", now known as Craines Point. Figure 1 shows outlines of the 13 specimens.

Among the specimens are several of the 2 well-known forms, plus several of intermediate character. One in particular exhibits both the classic simple lip of *Pedicula-*

ria californica, and, within the aperture, the classic dentated lip of *P. ovuliformis*. Remnants of the crenulate outer margin can be seen on the exterior, well below the aperture. The exterior color is very similar to that of *P. ovuliformis*, except that the shell added beyond the crenulations is lighter, close to that of *P. californica*. Figure 2 shows 2 of the specimens, one clearly *P. ovuliformis* and the other the intermediate form.

Other specimens in the collection show similar but less complete suggestions of both forms. Several have an easily identified smaller, darker "core," of the size and color of *Pedicularia ovuliformis*, surmounted by a lighter, more open, simple labrum, giving them the overall approximate appearance of *P. californica*. Microscopic examination shows evidence of overgrowth of a flat, heavy labrum, probably dentate, and possible remnant of interior overhang of the flat lip of *P. ovuliformis*. Table 1 gives the significant characters of these specimens and in Figure 3 is plotted the width vs length, which is seen to be approximately linear.

It is therefore not unreasonable to conclude that there is probably only one species of *Pedicularia* in Northern California, that *P. ovuliformis* is a phase leading to *P. californica* by partial resorption of the flat dentate labrum and simultaneous extension of a simple labrum, with size increase and reduced pigmentation. This possibility was also considered by BERRY (1946), who rejected it in favor of defining *P. ovuliformis* as a new species.

A possible explanation for these facts is the following: In the colder water further north, the growth rate is probably slower than in more southerly areas where *Pedicularia* is more commonly found. Thus, more time would

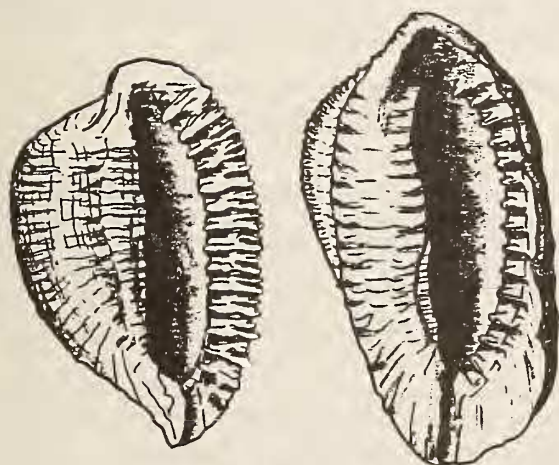


Figure 2

Drawings of two specimens, *Pedicularia ovuliformis* (No. 5), and the intermediate form (No. 6). Drawn from photographs

Table 1

Pedicularia from Cordell Bank 1978

No.	Length (mm)	Width (mm)	State	Dentation	Crenulation	Remarks
1	5.2	3.4	live	rudimentary	none	
2	5.8	3.7	dead	partial	none	
3	6.0	3.6		partial	rudimentary	<i>P. ovuliformis</i>
4	6.1	4.0		complete	partial	<i>P. ovuliformis</i>
5	6.2	3.5		complete	complete	<i>P. ovuliformis</i>
6	6.9	4.3	live	complete	residual	Intermediate form
7	6.9	4.9	dead	ambiguous	ambiguous	White; aperture unusual
8	7.9	5.0	live	none	none	<i>P. californica</i>
9	8.5	5.6	live	none	none	<i>P. ovul. core</i> , w/chg. of growth at junction
10	9.1	5.9	dead	rudimentary	none	
11	10.0	6.3	dead	ambiguous	partial	Lips somewhat thickened
12	10.4	6.0	live	none	none	Lips slightly thickened; has <i>P. ovul. core</i>
13	12.4	8.6	live	none	none	Lips extremely thickened; very heavy, several phases.

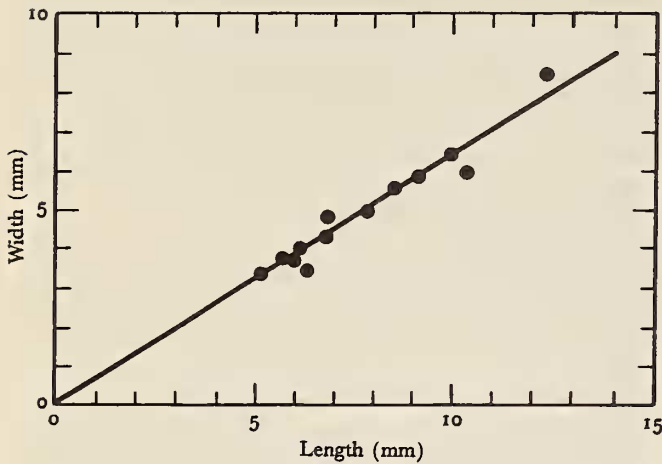


Figure 3
Width vs. length of the 13 specimens

be spent in making the transition from *P. ovuliformis* to *P. californica*, and the probability of finding the intermediate form would be correspondingly higher, accounting for its discovery at Cordell Bank. The individual reaches maturity as *P. ovuliformis*, spending some time on its color-encrypting substrate *Stylantheca*. Then, in response to an environmental change (which may actually be a change

in the substrate occasioned by a more primitive cause such as temperature), it suddenly puts on a growth spurt. In order to contain the animal, the outer lip is rapidly extended, leaving the flat, dentate margin as an interior shelf, which is then resorbed to clear the passage (resorption is known in other species of *Pedicularia*). Irregularity in form is due to the rapidity of growth - if conditions returned to the earlier state, it might well construct another flat, heavy, dentated outer lip. There is some evidence of this last, since the largest (and presumably oldest) specimens in the Cordell Bank collection have greatly thickened lips, and retain irregular forms.

These specimens have been deposited in the collection at the California Academy of Sciences, San Francisco, California, accession number 60363.

ACKNOWLEDGMENT

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